This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

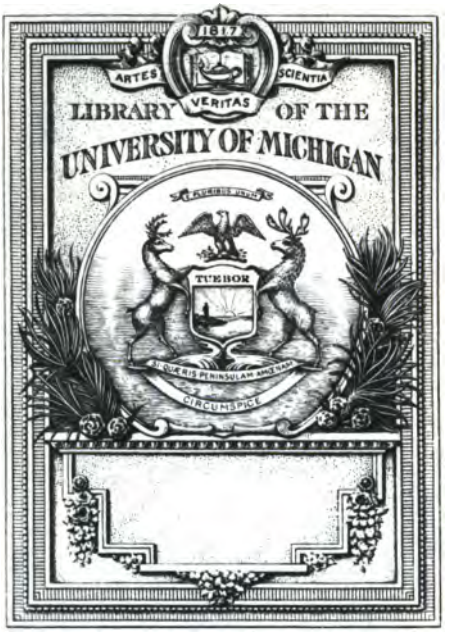
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`


ARTES
VERITAS
SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
TUEBOR
SI QUAERIS PENINSULAM AMOENAM
CIRCUMSPICE

TL
405
.V44

VELOCIPEDES,

BICYCLES, AND TRICYCLES

R. Todd.

VELOCIPEDES,

BICYCLES, AND TRICYCLES:

How to Make and How to Use them.

WITH

A SKETCH OF THEIR HISTORY, INVENTION,

AND PROGRESS.

BY "VELOX,"

WITH NUMEROUS ILLUSTRATIONS.

LONDON:
GEORGE ROUTLEDGE AND SONS,
THE BROADWAY, LUDGATE;
NEW YORK: 416, BROOME STREET.
1869.

R. Todd.

WYMAN AND SONS, PRINTERS,
GREAT QUEEN STREET, LINCOLN'S-INN FIELDS,
LONDON, W C.

26 Sep. 19 E.H.W.

PREFACE.

Reclass 11-4-39 mgr

WHETHER velocipedes are only the "toy of the hour," or are destined to become a permanent adjunct to our civilization and every-day life or not, no one can doubt their extending popularity, or that there exists a widespread desire to know how to use, and the best form of construction for, the new wheel-horse of the period.

338776

The desire to possess a pedo- or manu-motive carriage is not new. Even the two-wheeled velocipede is half a century old, and the journals of the mechanical arts record a thousand and one ingenious contrivances of springs, sails, wheels, pedals, and cogs to annihilate space in the ante-railway era. Many of these ideas are now being reproduced as original, though long ago they were tried and found wanting in some material point. Their ingenuity is unquestioned, their utility doubtful. They could not accomplish, with their plethora of mechanical contrivances, what the new-fashioned bicycle and tricycle do by the most simple and direct means.

Time alone can tell whether the newer fashion will share the fate of the old; for, after all, more depends on the road than on the vehicle.

This little manual does not pretend to record all the vagaries enrolled in the Patent Office, but it embraces all the salient practical points of the history of velocipedes. The most remarkable inventions are pointed out, as well as the causes of failure, when they can be ascertained. The reader will find well-authenticated facts, mechanical principles, and the practical experience of myself and others, set forth clearly and precisely.

Reference has been made in the

following pages to the *Repertory of Arts*, *Magazine of Science*, *Mechanics' Magazine*, the *Patent Journals*, the *Engineer*, *English Mechanic*, the *Scientific American*, *Harper's Weekly*, *L'Univers Illustré*, and other serials. I have also to thank several gentlemen for permission to use their drawings, and for the valuable hints they have supplied to me.

VELOX.

Leamington, 17*th April*, 1869.

CONTENTS.

INTRODUCTORY . . . . . *page* 11

ADVANTAGES OF VELOCIPEDES 17

THE VELOCIPEDES OF THE PAST 21

THE FIRST VELOCIPEDE 24

THE ROCHELLE VELOCIPEDE (*Illustrated*) . . . 25

THE CÉLÉRIFÈRE 27

THE HOBBY-HORSE (*Illustrated*) 30

THE DANDY HORSE (*Ditto*) 32

BAYNES'S LEG PROPELLER 35

GOMPERTZ'S VELOCIPEDE (*Illustrated*) 36

DUMBELL'S MILLIPEDE 38

M. DREUZE'S WHEEL-HORSE 40

THE GO-CART 41

THE VELOCIPEDE OF THE DAY. 45

THE CANTERING PROPELLER (*Illustrated*) . . . 47

THE LAMBELLE 48

THE RIVIERE 49

THE BICYCLE (*Illustrated*) 51

THE FRENCH BICYCLE (*Illustrated*) 52

THE PARISIAN BICYCLE (*Illustrated*) 53

THE AMERICAN OR PICKERING BICYCLE (*Illustr.*) . 54

THE HANLON (*Illustrated*) 55

THE KEYSTONE VELOCIPEEE 57

THE TRICYCLE 59

GERMAN TRICYCLE (*Illustrated*) . . . . . *page* 60
THE ELYRIA TRICYCLE (*Illustrated*) 62
THE WILMINGTON TRICYCLE (*Illustrated*) . . . 63
THE LADIES' ENGLISH TRICYCLE (*Illustrated*) . . 66
THE LADIES' PARISIAN TRICYCLE (*Illustrated*) . 67
FOUR-WHEELERS 70
THE DUBLIN FOUR-WHEELER (*Illustrated*) . . . 73
THE DUBLIN VELOCIPEDE (*Illustrated*) 72

ART OF VELOCIPEDE MANAGEMENT . . . 77

HOW TO MANAGE A BICYCLE 79
THE MOUNT (*Illustrated*) 80
THE START—JUST OFF (*Illustrated*) 81
PREPARING TO GO DOWN HILL (*Illustrated*) . . 83
DOWN THE INCLINE (*Illustrated*) 85

HOW TO CONSTRUCT A BICYCLE 89
DIAGRAMS OF PARTS 94-104

VELOCIPEDUM VARIORUM 107
THE SAIL VARIETY 107
THE PODOSCAPHE 108
THE STEAM VELOCIPEDE 109
THE ICE VELOCIPEDE 111
THE ONE-WHEEL VARIETY 112
THE VICTORINE 112
THE CHILD'S VELOCIPEDE 113

PROGRESS OF THE VELOCIPEDE 117
IN FRANCE 117
IN AMERICA 120
IN ENGLAND 125
CONCLUSION 127

INTRODUCTION.

WHEELED chariots may claim a high antiquity. When the Pyramids were young the chariots of Pharaoh were in existence, and we can trace them through each successive wave of civilization. We know that our ancestors were acquainted with their use prior to the Roman invasion. Like the coach, they were of rude workmanship; but the mind that designed and constructed them probably dreamed of some mode of dispensing with the cattle necessary to move them. Even then canoes moved on the face of the waters and ships on the sea; and it is more than probable that a similar motive power was looked for on land. The

conditions were, however, unfavourable, and the thought, if entertained, was abandoned. The go-cart of our childhood is not a modern idea, but it is the germ of the velocipede. The primitive idea was hardly improved upon until our own day. The "go-cart" supported the body, and the feet of the child supplied the motive power: the modern bicycle does no more. The power is differently applied, it is true, but the general principle remains the same. That velocipede is the best and most in favour which, with the least expenditure of power, attains the greatest speed by the action of the feet alone. The various forms which have been tried to accomplish this, the diverse means employed, and the mechanical aids suggested, form an amusing chapter of the history of invention.

Whether velocipedes will ever become a necessity of our civilization—the "fast" adjunct to our "fast" age—it is impossible to say, though appearances would warrant such a

prediction. There are enthusiasts who see in a bicycle the solution of some gnarled social problem, and believe that a tricycle will obviate some festering evil of our era, though at present the popular toy of the hour only flatters our pride by giving power over space; and there are those who sneer at the new-fangled carriages, and point out that similar machines have been tried before, and, for practical use, have been found wofully wanting. They predict ruptures, sprains, dislocation, and death as the penalty of using these mechanical contrivances. They point out that they are excessively laborious to work, that there are a thousand abstract arguments to prove why they cannot succeed; yet, while they are proving the negative, the velocipedes are positively to be found in our streets by hundreds, and our gymnasiums and riding-schools are thronged by anxious learners and expectant possessors of the new iron horse and carriage combined.

If the velocipedes of to-day were of the same

construction as those which belonged to the past, no reasonable individual could deny that their use involved danger and fatigue, without any compensation whatever to repay in any adequate sense the labour involved, for those who tried them found that, though they succeeded in a certain sense, success was achieved at such an expenditure that it was compared to employing an elephant to draw a wheelbarrow. The modern principle was present in the old "hobby," or, as it was sometimes called, the "dandy" horse, but the power was misapplied, and consequently wasted; hence the failure and abandonment of the idea of making the velocipedes either popular or permanently useful. The shaking, squealing three or four-wheel spasmodic machines were discarded, and placed in the same category as flying-machines and perpetual motion.

It would be almost useless now to attempt to demonstrate mathematically the exact gain or waste of power which velocipedes give or

consume. It makes very little difference to a good walker whether the road is of gravel, smooth pavement, or an average macadamized road; but in a wheeled carriage the difference is much greater. The loss of power in walking is calculated at five per cent. between walking on a pavement and a gravel road, and forty-five per cent. in the case of a two-wheeled carriage. On bad roads velocipedes are at their minimum advantage. On smooth roads they are pleasant, useful, and capable of performing all that enthusiasts claim for them. There is little doubt they will remain permanently amongst our institutions, for they supply a want and meet the requirements of a large section of the people.

Their advantages may be briefly stated. They enable individuals to travel faster and greater distances with a less expenditure of vital force than by walking, provided the machine is as light and simple in its construction as possible, so that waste may be reduced to a minimum. Some of the objectors to velocipedes

on abstract grounds base their arguments on the assumption that when a man walks he economizes his power to the utmost; and where the ground is rough and uneven, or in the ascent of a steep hill, probably this is so; but on level ground, or in descending inclines, there is greater waste of force in proportion to the progress. Every time the foot touches the earth there is waste. When we walk, the body moves in a succession of waves, which may be observed when a body of drilled men march together. If we could move forward in a straight line, we should save this loss; and this the velocipedists say they do. They also affirm that there is a large expenditure of power in supporting the body in walking, so that a small portion only is left for actual propulsion, "whilst in travelling on a velocipede the man is supported by wheels, and he can exert the whole of his power in propelling." There is much reason in this, and the experience of velocipedists confirms the theory.

They urge that when velocipedes were introduced a generation ago, it was the fashion to decry muscular exertion, and to elevate mental improvement, until our clerks and shopkeepers were pale and indolent dyspeptics instead of vigorous and healthy members of the human family. If the velocipede only popularize bodily exercise among the sedentary class, no one will affirm that their mission is a fruitless one.

The power and advantages of velocipedes have been well advocated during the past year in the scientific periodicals, and some of the arguments are interesting. Thus one gentleman points out that "walking requires a tractive force equal to 1-13th of the man's weight. A wheeled vehicle on a gravel road (which is one of the worst) requires 1-16th of the gross weight; on a well-macadamized road about 1-40th; on the best London pavement 1-70th; on well-laid flagstones 1-180th; and on a railway 1-224th. If we take a man's

expenditure of force in rowing or working a velocipede as equal to 53 foot pounds per second, and 30 miles equal to a day's walking, we shall find that a man weighing 150 pounds on a velocipede weighing 80 pounds (and we should remember that the weight of the best bicycles does not exceed 56 pounds) will travel on a road where the traction is 1-40th from 50 to 60 miles easier than he will walk 30, even if he uses a four-wheeler. On the best London pavement he might travel 90 to 100 miles, and on a railroad about 270 miles a day."

Doubtless there will be many scoffers at the idea of a man being his own horse, and at self-propulsion generally. I will give the following problem, which appeared in the *Mechanics' Magazine* as far back as 1831 :—

"How can a man without touching the ground, or having any lever or instrument in his hands or elsewhere, wheel himself up the steepest road in the kingdom in a common

wheelbarrow?" There is no trickery in the thing. "Let a man take a common wheelbarrow, without addition of any kind, having on ordinary-sized wheel of eighteen or twenty inches diameter, and (as very steep ground may not be near) let a square bar, of one inch thick, be put before the wheel under it upon hard level ground, which will be equivalent to a hill rising more than one in three; then let him mount the barrow, and without his touching the ground, cause it to wheel, with him in it, over the bar." This is how it is done, and solves the problem of self-propulsion under very difficult circumstances. "A medium effect will be produced by sitting on the foreboard of the barrow, with the wheel between the legs, and pushing the wheel round with the hands. But as the problem is a maximum, it can only be solved by standing astride on the side bars of the barrow, a little in advance of the axle, with the face towards the barrow, laying hold of the wheel by its

felloes, and pulling, or rather throwing, all the weight of the body backward, which will draw the wheel and all with it over the bar." When this is possible, velocipedists need not despair, for they can do more than this with their improved bicycles if they practise and persevere.

THE VELOCIPEDE OF THE PAST.

THE VELOCIPEDE OF THE PAST.

UNTIL the past few months it was always understood that velocipedes were invented about the year 1819, but recently one daring writer has asserted that the idea was coeval with the invention of the crank, which, after all, gives no higher antiquity, for, strange to say, the simplest of all inventions for turning a vertical into a rotary motion is not so old as the century. The Parisians, who have the honour of resuscitating and making velocipedes fashionable, and yet popular, claim the honour also of its invention. They point to the *Journal de Paris* of July 27, 1779, which describes a

vehicle invented by the celebrated aëronaut M. Blanchard in connection with M. Masurier. As far as can be judged from the description, this machine was a combination of the hobby-horse and trolly: one man was seated in front, and acted as driver or guide, whilst another supplied the motive power by pressing his feet alternately on the ground. This individual must have had a hard time of it, for it was found exhausting work to move the old velocipedes by the same means, though the weight could not have been more than a third of M. Blanchard's machine and driver. It is thought (for there is little known positively on the subject) that the manual power was aided by some mechanical contrivances, of which springs formed a part. This invention was exhibited both at Paris and Versailles, but it does not appear to have met with either royal or popular favour.

I have a drawing of a velocipede invented by M. Richard, a physician of Rochelle, which

appears to have much in common with M. Blanchard's contrivance. It has a canopy for the driver, or rather for the steerer, whilst the motive power is supplied by a servant standing behind (Fig. 1).

Fig. 1.—A VELOCIPEDE OF THE EIGHTEENTH CENTURY.

At first sight it would appear as if the pedal and crank were used by the servant to turn the hind wheels, and thus force the cumbersome machine along. Conjecture here

is useless, for we have fortunately the diagram of the power employed, which is worthy of note, for it shows one of the numerous plans used to obtain a circular motion without using a crank.

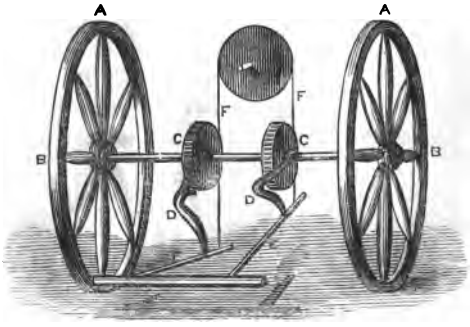


Fig. 2.

Thus A A are the two hind wheels of the velocipede connected together by the axle BB. On the axle are two toothed wheels C C, and by the outer side of C C are two crooked arms D D moving freely on the axle as on a centre. At the elbow they have a detent tooth

attached, which catches the teeth of the wheels C C alternately, as the treadles E E are raised or depressed, by means of a cord F F, which is tied to the end of the treadles, and passes over the pulley G, which is fastened to the back of the carriage and moves freely on its axis; as one treadle is depressed by the weight of the foot, the other is raised. The weight of the man acting on the pedal and elbow causes the wheel C to revolve, and with it the axle and driving-wheels A. This action reversed and repeated causes the carriage to move slowly along. Speed with such a machine was out of the question. The *vis inertiæ* of such a machine, on roads ignorant of McAdam, must have sorely taxed the strength and patience of M. Richard's unfortunate servants.

A generation later the *célérifère* made its appearance in the gardens of the Luxembourg; but, from the caricatures, it was evidently but a clumsy variation of the old hobby-horse, with its low wheels and rupture-producing

movements. We, who are familiar with the controlling power and automatic movements of the modern bicycle, can hardly realize the formidable difficulties of this unmanageable and barbarous contrivance. It was propelled by the action of the feet on the ground; there were no means of guiding, controlling, or directing its movements; whilst an unfortunate slip or false movement resulted in painful sprains.

Whether M. Niepce, for whom the invention of photography is claimed, ever saw the wonderful *célérifère*, or only the many caricatures to which it gave birth, will probably never be known; but if we may judge from the extracts of letters addressed to him by his brother Claudelle, then residing at Hammersmith, and lately published in the *Monieur de la Photographie*, Nicephore Niepce must have succeeded in making a passable velocipede, which, judging from the first letter, dated November 19, 1818, was propelled by

the action of the feet on the ground in the same manner as the dandy-horse; but the practical mind of the writer pointed out that its utility would be in a great measure confined to those parts where the roads were kept in good order. The second letter is dated on the 21st of December the same year, and alludes to the probable sale and popularity of them in England; and the third letter, dated the 24th August, 1819, alludes to the fact of their being in England, but the writer's means would not permit him to purchase one, even if he was not afraid of the raillery of his friends in Hammersmith.

This brings us to the regular historic period of the introduction of velocipedes. Amongst those which were then introduced was the following, sketched more than thirty years ago. It was rude and primitive in construction (Fig. 3).

A velocipede somewhat similar in construction was brought regularly into Northampton

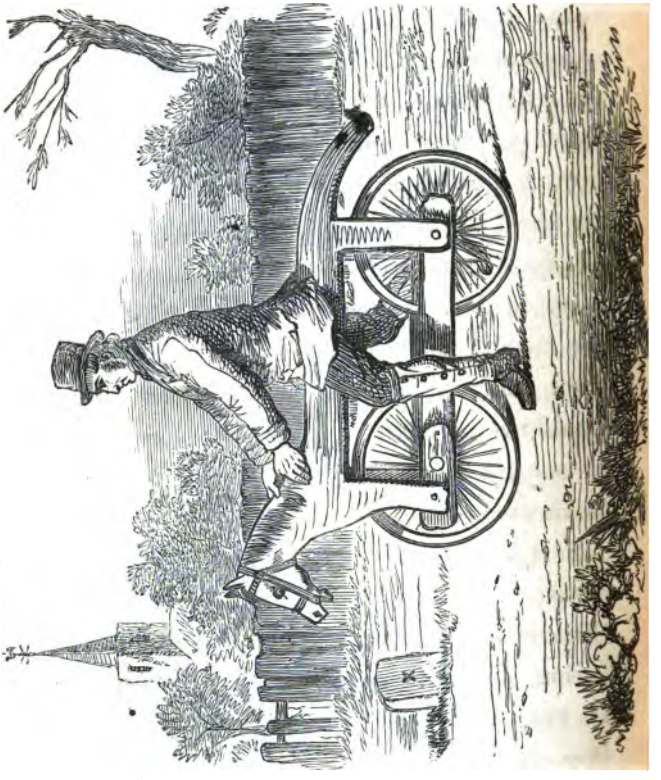


Fig. 3.

market from Yardley Hastings until a few years ago; but it was fancifully ornamented with gnarled pieces of wood in the form of serpents, snakes, and animals; and one yet remains in the little village of Harpole, near Weedon, in the same county. The use of this machine caused a tendency to rupture, and, as accidents were frequent, it became neglected, and has long since been disused. It comes nearer to the "Dandy-horse" (Fig. 4)—the well-known velocipede of fifty years since.

A reference to the old French patent lists shows that on the 17th of February, 1818, one Louis Joseph Dineur, residing at No. 47, Quai de l'Horloge, Paris, acting for Baron von Drais, of Mannheim, secured a patent for five years, for a "*machine dite vélocipède,*" which is thus described:—"Pour une machine appelée vélocipède formée d'un siége porté sur deux roues, qui obéissent facilement aux movemens des pieds d'une personne assise sur le siége et

qui transportent cette personne avec grande vitesse. Au Sieur Dineur."

Fig. 4.—DANDY-HORSE.

This machine was patented in England by Denis Johnson, coachmaker, of 75, Long Acre,

in December, 1818, and was evidently a "communication from abroad." It is described in a contemporary newspaper in these terms:—

"A CURIOUS INVENTION. — In *Ackerman's Magazine* for this month (Feb., 1819) is an account of a machine denominated the pedestrian hobby-horse, invented by a Baron von Drais, a gentleman at the court of the Grand Duke of Baden, and which has been introduced into this country by a tradesman in Long Acre. The principle of this invention is taken from the art of skating, and consists in the simple idea of a seat upon two wheels, propelled by the feet acting upon the ground. The riding-seat, or saddle, is fixed on a perch upon two double-shod wheels running after each other, so that they can go upon the footways. To preserve the balance, a small board, covered and stuffed, is placed before, on which the arms are laid, and in front of which is a little guiding-pole, which is held

in the hand to direct the route. The swiftness with which a person well practised can travel is almost beyond belief—eight, nine, and even ten miles may, it is asserted, be passed over within the hour on good level ground. The machine, it is conjectured, will answer well for messengers, and even for long journeys; it does not weigh more than 50 pounds, and may be made with travelling pockets."

A reference to *Ackerman's Magazine* gives us some additional particulars. The Baron, it appears, had previously invented a self-propelling carriage, but the labour of working it led to its disuse. On the dandy-horse, called, we learn, *Draisena* in Paris, and *Drais Laufmashin* by his countrymen, "the Baron travelled from Mannheim to the Swiss relay houses and back again, a distance of four hours' journey by the posts, in one short hour, and he has lately, with the improved machine, ascended the steep hill from Gernsbach to

Baden, which generally requires two hours, in about an hour, and convinced a number of amateurs assembled on the occasion, of the great swiftness of this very interesting species of carriage." The price, we are told, was from £8 to £10. Its appearance is accurately depicted in Fig. 4; the hind wheels are supported as in the modern French Bicycle (Fig. 8), and the front wheel is steered by a handle acting directly on the axle, independently of the fork.

The introduction of the Baron's velocipede gave an impetus and a new direction to the inventive faculties. The first recorded fruit is a patent granted to a working cutler of Leeds, named John Baynes (patent No. 4,398, September, 1819). His notion consisted of removing the feet from the ground and substituting a series of crutches, which were moved by treadles and levers. A much better contrivance was the improvement of Mr. Lewis Gompertz, who had previously patented several improve-

ments in carriages. He seized the idea of aiding the legs of the rider by applying power direct to the driving-wheel, by means of a toothed rack acting on a pinion fixed to the axle of the front wheel. This ingenious contrivance

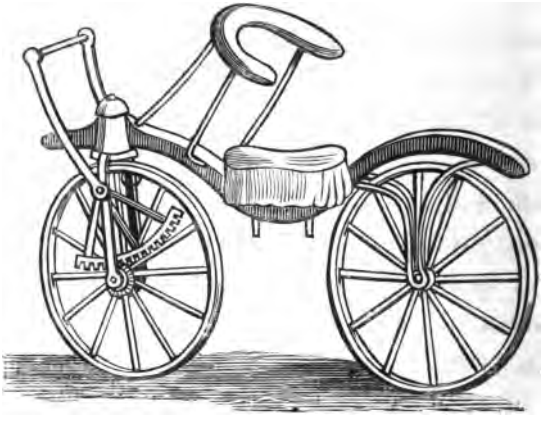


Fig. 5.—GOMPERTZ'S VELOCIPEDE.

is shown in Fig. 5. The handle is moved backwards and forwards by the hands and arms of the rider, and thus brings the toothed segmented rack against the pinion. Mr. Gompertz says, "The circular rack must be

a sufficient portion of a circle to admit of a full contraction of the arms of the rider, and of nearly a full extension likewise, because when the velocipede goes backward, the rack must be kept still beyond the pinion, in which case the arms are extended rather more than when they are in motion; and were this not extended to the handle, would be drawn out of the reach of the rider." Mr. Gompertz made the riding-beam of beech strengthened with iron: the other parts were of iron and steel. He also anticipated Mr. Dana's notion, of a special roadway for velocipedes. He was modest enough to confine his wish that one side of the public highways should be devoted to this purpose. Thus this Surrey invention approached closely the construction of the modern bicycle. He failed from that love of cogs, pinions, and toothed wheels, which was the besetting weakness of velocipede designers.

If we wish to see how ideas and events reproduce themselves, we have only to turn

to the Patent List, No. 4,737, December 16, 1822, and the *English Mechanic* for 1868. In the former, Mr. John Dumbell describes his idea of an improved velocipede, and in the latter (July, 1869), an imaginative individual describes nearly the same contrivance. The wheels in both instances were to consist of a series of curved spring spokes without felloes or tires, or projecting beyond them, in order that the elasticity of the spring might assist the onward progress of the vehicle. This idea in various forms seems to have taken hold of the minds of many individuals, nearly a score of patents having been applied for. Some years ago I was invited to inspect the agricultural improvements of a gentleman residing in the neighbourhood of Ashby-de-la-Zouch. He had invented many ingenious contrivances for saving labour, and he showed me, amongst other features, a pair of wheels constructed on this principle. Outside the tires, all round the wheel, were a number of longitudinal pieces of

iron attached by springs, similar to the endless rail of a modern traction engine. In the model the contrivance worked well, but in practice the wheels were a failure, no extra speed was gained or power saved; on the contrary, the friction was so great and the liability to derangement so constant, that the wheels had to be abandoned.

During the next ten years, some further changes were proposed in velocipedes. A Mr. Jameson proposed a modification of the Rochelle velocipede in 1824, and treadles and lever became common. The present bicycle was evidently thought of, but the liability to overturn was supposed to be so great, that four iron rods were proposed to project from each side, to which small wheels were attached to support the rider in his seat. A contrivance about as useful as a tight-rope dancer's balancing-pole would be to a horseman in a crowded highway.

In 1830 a bold and vigorous attempt was

made to utilize the wheel-horse. A French post-office official, M. Dreuze by name, brought forward an improvement on the old two-wheel velocipede, which bid fair to be successful. He communicated the power directly to the axles of the wheels, so that they became a source of power instead of wasting it. A number of the country letter-carriers were mounted on the wheel-horse, and whilst the roads continued dry and hard M. Dreuze could congratulate himself on the success of his invention; but with wet weather came bad roads, and to the wet succeeded frost and snow. A little extra labour was all that was required to overcome the extra friction of the bad roads, but the wheels refused to progress on the slippy frozen surface. What was to be done? The country folks wanted their letters, and the wheels of the velocipedes would not move except in an absurd manner on their own axis; so the poor postmen had to trudge off on foot, and leave

their velocipedes behind them. The difficulty was not an insuperable one, but the new vehicles fell into desuetude in consequence, aided, probably, by the inertness and apathy of the Governmental *employés*.

The favourite idea of English mechanics during the next generation was the four-wheel velocipede, working with treadles and levers on a cranked axle, the idea being to use all four wheels as driving-wheels at once. One of the most notable exceptions was a modification of the go-cart. The body of the rider was proposed to be supported by an iron ring, from which arose short crutches to fit the armpits attached to the centre of the axle of a pair of six-feet wheels. The feet would supply the motive power, and the hands would be free to steer by means of a lever. This notion has been reproduced during the present velocipede *furore*.

The twenty years which elapsed between 1841 and 1861 were nearly blank velocipede

years. Only two or three suggestions were made, and only one patent applied for. In 1861 the attention of mechanics was again directed to the construction of velocipedes, and the Journal of the Commissioners of Patents records several specifications, which it is unnecessary to repeat here.

THE VELOCIPEDE OF THE DAY.

THE VELOCIPEDE OF THE DAY.

THE BICYCLE.

It would have been a slur on the mechanical genius of a manufacturing age if no machine could be invented to enable man to have quicker, easier, and safer modes of transit than those which depend on expensive appliances and combination of labour and capital, or those which rely on animal assistance. Some of our best machines are the simplest, and inventors have too frequently erred by using complicated movements when the simple ones were within their grasp, and far better adapted for their purpose. Thus it is said that Watt devised a thousand schemes for turning a vertical into a rotary or

an horizontal one, but did not think of the crank. The simplicity of the dandy-horse, or, as we should term it, the Von Drais velocipede, was all that could be desired, but it unfortunately did not utilize the power of man. The extra speed was gained at a vast expense of power. The wheel-horse of that day was not under control—it was crude. It wanted the crank, and unfortunately for the enthusiastic velocipedists, it was not adapted to it. When cranks were used they were adapted to a four or three-wheeled carriage, with what success I have shown. Cogs, pinions, cranks, wheels within wheels, and all mechanical contrivances to gain power did so at the expense of speed; and though many of the contrivances are admirably adapted to enable invalids to move themselves about in a Bath chair—nay are even now manufactured for that purpose, nevertheless for speed the power must be applied direct; and how this has been accomplished a glance at the American patent records will speedily show us.

First in point of time was the "Cantering Propeller," invented by Mr. P. W. Mackenzie, a citizen of the United States, who in 1862

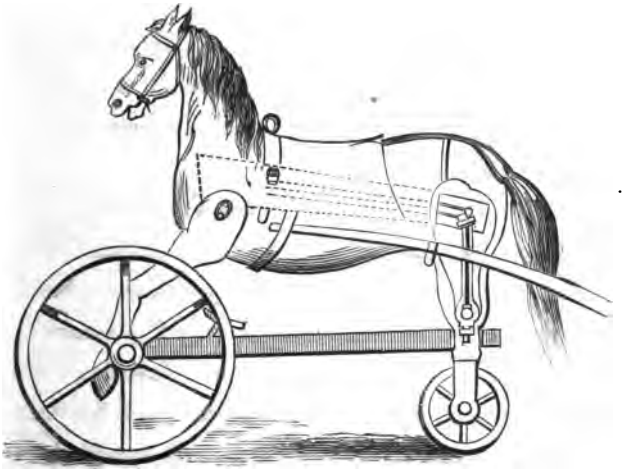


Fig. 6.—THE CANTERING PROPELLER.

patented in America an automatic horse (Fig. 6), and has since reissued the patent with a view evidently of covering the whole ground of American manufacture now in dispute between Messrs. Witty and Smith for the

Lambelle principle. The claim has been reissued in the following terms :—

1. I claim, in combination with a saddle seat for the rider, the employment and use of a cranked axle, arms and foot-rest, so arranged that the power applied by the feet of the rider shall give motion to the vehicle, substantially as described and specified.

2. The combination of the following elements; namely a saddle seat for the rider, a cranked axle for propelling the vehicle by power applied by the feet of the rider, and a steering mechanism, so constructed that the direction of travel of the vehicle may be governed by the rider, substantially as described and specified.

3. The universal joint, in combination with the fulcrum of the vehicle and the steering-wheel, constructed and operating substantially as and for the purposes specified.

4. The hinged legs in combination with the body of the horse and with the cranks, substantially as and for the purposes specified.

5. The foot-rests upon the arm, substantially as and for the purposes specified.

6. The double-armed levers and diagonal cords in combination with the handle and steering-wheel, substantially as described and specified.

There is no doubt that this claim embraces all the essential points of the modern bicycle.

A Monsieur Rivière describes in the patent journals his improvement on the old dandy-horse. He fixed the axle of the front wheel so that it rotated with the wheel itself, and passed through headings formed in the vertical steering-fork of the vehicle, and each end of the axle was provided with a crank having a balance foot-plate, so that the rider could give motion to the machine through the cranked axle which actuated the front wheel, instead of pressing his feet against the ground as in the old arrangement. This is the exact arrangement of the modern bicycle driving-wheel. He also points out:—"In constructing a velocipede

according to this invention, I prefer that the seat or saddle should be supported by a spring, and that a cross handle should be provided for actuating the vertical steering-fork of the front wheel, such cross handle being connected by a strap to one end of a lever of the first order, having its fulcrum in the main beam of the vehicle, and the lever being so arranged that by partially rotating the cross handle upon its axis the front end of the lever is drawn up, and its lower end simultaneously actuates a spring brake, which is pressed against the periphery of the back wheel of the velocipede, thus retarding its motion as desired. When not required to be used, the lever is kept out of action by a spring provided for that purpose. The two wheels must be in a line with each other, and I prefer that the front wheel should be somewhat larger in diameter than the back one." Had M. Rivière completed his specification, and added the necessary drawings, he would have been the patentee of the bicycle.

Whether he was the inventor, or whether he had previously seen the French or American bicycle, we have no means of knowing.

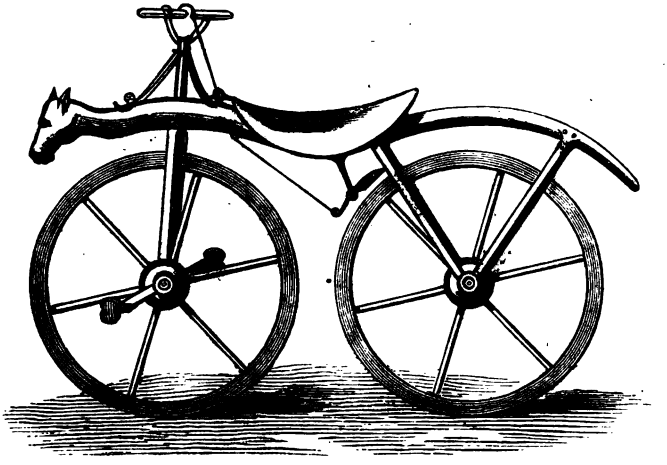


Fig. 7.—THE BICYCLE.

Thus, like many useful inventions, the real inventor of the modern bicycle is open to grave doubt. The simplest form and the easiest made by amateurs is shown in Fig. 7. If this velocipede was made with a brake, either self-

acting, as in Fig. 10, or with a cord to the guide-handles, it would be peculiarly well adapted for heavy men. It has the simplicity

Fig. 8.—THE FRENCH BICYCLE.

of the old dandy-horse with the power and improvements of the modern bicycle.

We are now face to face with the most popular form of the French bicycle (Fig. 8). The pattern is that made by Mr. Lisle, of Moorfields, Wolverhampton. It is fitted with lamp

and brake complete. The brake is worked by turning the guide-arms. It has all the essentials both in theory and in practice of a first class and useful velocipede.

Fig. 9.—PARISIAN BICYCLE.

A very strong, popular, and showy form of velocipede is that shown at Fig. 9. The brake can either be made self-acting by the action of the iron frame on the hind wheel, or a brake may be placed as shown in the

French velocipede (Fig. 8) preceding. I have shown the triangular reel-treadles in place of the weighted slipper.

When the bicycle reached America, the various manufacturers introduced improvement

Fig. 10.—THE AMERICAN BICYCLE.

and varieties of patterns. The pattern known in America as Pickering's (Fig. 10) has become known and popular in England as the American Bicycle. The saddle is supported on a spiral spring, and fitted with a self-acting brake beneath.

The patentees claim for this pattern great credit. They affirm that it is simpler, more durable, lighter, stronger, and cheaper than

Fig. 11.—THE HANLON VELOCIPEDE.

either of the French patterns. The great feature of difference is, however, the connecting apparatus. In this the saddle-bar serves not only as a seat but as a brake, and is not

attached to the rear wheel. By a simple pressure forward against the tiller, and a backward pressure against the tail of the saddle, the saddle-spring is compressed, and the brake attached to it brought firmly down upon the wheel.

Another of the American patterns is the one introduced by Hanlon Brothers (Fig. 11), and known by their name.

In this the extending or sliding crank for the pedal was made a feature. The bearings of the guide-fork admit of easy lubrication and cleaning. The saddle is placed on a spring of wood or metal. Its great drawback is the want of a brake. It has met with little favour in England, though its simplicity and strength deserve a favourable consideration.

There have been some modifications of the bicycle patented. One notably by Mr. W. E. P. Gibbs, of London, in which the hind wheel is driven by cranks, whilst the

front wheel is very small, and is simply used for the purpose of guiding the vehicle. The experience of all velocipedists points to a large driving-wheel in front as the best and easiest to work.

The American papers mention the invention of a velocipede of an entirely new style, called the "Keystone," invented by Professor Lowback, of Philadelphia, and so named by him in honour of his native state. It has but two wheels, and the seat is quite low between them. The novelty consists in a cog attached to the guiding-post, by means of which the rear-wheel is made to follow directly in the track of the driving-wheel. The description is not very explicit; but we are further told that no matter how short the curve, both wheels make it at the same time, and the seat always remains parallel to the driving-wheel. In the other machines there is no guide to the rear wheel, and consequently the machine cannot be turned so readily when a

collision is threatened. In practice, however, this alleged drawback does not exist, as the French bicycle can be turned round almost in its own length. In a room or riding-school no doubt the "Keystone" would be useful.

THE TRICYCLE.

In all probability the three-wheeled velocipede will have a more enduring and wider-spread popularity than the two-wheeled. Not that those in present use are safer or even easier to guide than the bicycle, but they permit the body to remain in a sitting posture when going down hill and when the machine is at rest. An artist can sketch from the seat. It can be taken to a shady nook while the luncheon or quiet pipe is enjoyed, and what is lost in speed is made up in comfort. There are, however, some drawbacks. Strange as it may appear to the uninitiated, the tricycle is far more likely to upset the tyro than the bicycle. Some modifications in the form of the machine have been made which bid fair to remove this objection.

The simplest form of a tricycle is shown in Fig. 12. It is one of those manufactured by Mr. Lisle, of Wolverhampton, and is known

Fig. 12.—GERMAN TRICYCLE.

as the German tricycle. It is, in fact, a converted bicycle of the American pattern. The rear wheel is removed, and its place supplied by a pair of wheels, running free on an axle

two feet long. The motive power is supplied by the crank pedals attached to the front axle. There is not much loss of power in this form of bicycle, but there is a tendency to turn over when the machine is not running on the crown of the road.

The Americans cling pertinaciously to the direct action principle, and whilst they have recognized the disabilities under which the bicycle labours, they have endeavoured to overcome these blemishes without reverting to the treadle and lever. A machine has been invented by Messrs. Topliff and Ely, of Elyria, Ohio, which attempts to combine the advantages of both the bicycle and the tricycle, by means of a depressed V axle to the rear wheels. This axle, by means of a lever, enables the rider at will to change the distance between the hind wheels from two feet to two inches, or less, so that he can practise in the beginning on the three-wheels, and as he gains confidence can change the

machine practically into a bicycle. Fig. 13 shows a perspective elevation of this machine. The diagrams showing the action of the rear wheels are shown on p. 127. They may be made to run on any portion of the axle, and are prevented from

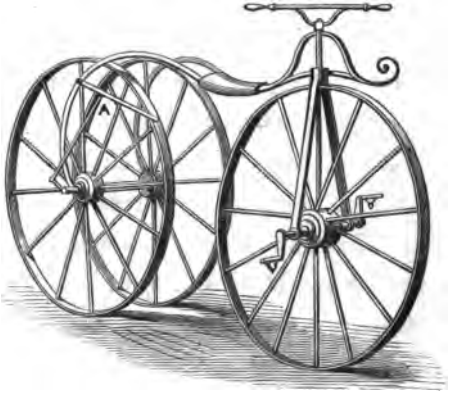


Fig. 13.—THE ELYRIA VELOCIPEDE.

coming together by the fixed collar at B. The lever for turning the axle is shown at A.

A recent number of the *Scientific American* contains the drawing of a tricycle, which has many advantages to recommend it (Fig. 14). It was designed by Mr. John Tremper, of

Wilmington, in the United States. It has the driving-wheel in front, with the direct action

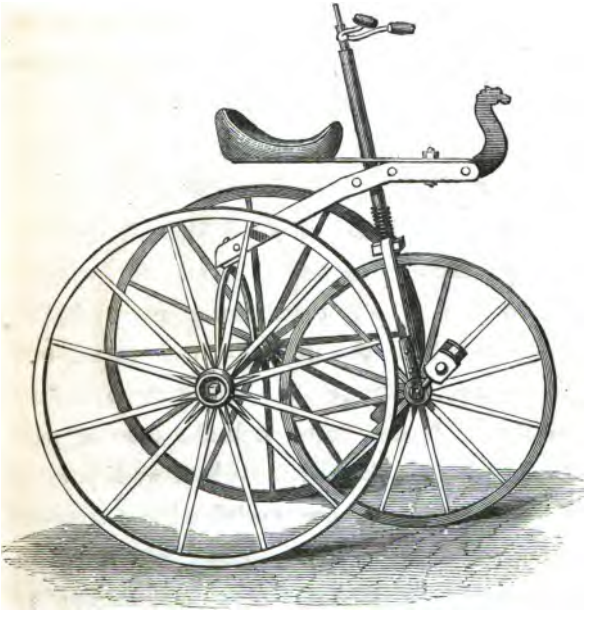


Fig. 14.—THE WILMINGTON TRICYCLE.

of the reel pedals, but the wheel is placed much nearer to the rear wheels than any of

the tricycles yet made. This gives the rider a more complete control over the motion and action of the machine, and enables it to turn corners with the safety and celerity of the two-wheeler. Its construction is thus described:—"From the axle of the hind wheel rises a bow-shaped brace, to which is bolted one end of the reach, which consists of two parallel pieces of wood bolted together, and embracing between them an upright standard or pipe, terminating in a forked brace, in which the driving-wheel turns, and having directly over the wheel's rim, where the forked braces unite, a brake-shoe or pad. The weight on the driving-wheel and part of that of the rider are sustained by a spiral spring, as seen in the woodcut, which serves as a buffer in passing over irregularities of the ground. The steering-bar, which is a prolongation of the forked brace, passes up through the hollow standard, and is furnished with handles, as usual, at the top. The seat, or

saddle, is sustained by two cast-steel springs, secured to the front of the reach by means of a cross strap, or block and bolt, so that it is easily adjusted further to the front or rear, as may be desired. The upright tube may also be adjusted in the reach to suit the length of legs or arms of the rider." Some of the points in this machine are well worth the careful consideration of the velocipede manufacturer. A leg-rest would improve it. Its good qualities would recommend it on fair roads; indeed the great, if not its only drawback, is the width of the hind-wheels apart, which would prevent the rider from picking his road with the ease he does on the bicycle.

Several modifications have been proposed, but none of the machines using the front wheel as a driving-wheel differ materially in form or construction from those delineated.

The tricycle, when fitted with a seat instead of a saddle, became a favourite with the fair

sex of Paris. The necessity of the case suggested many modifications in the construction of the machine. The front wheel is only used for steering purposes, and as a support to the reach. The power is supplied by treadles and

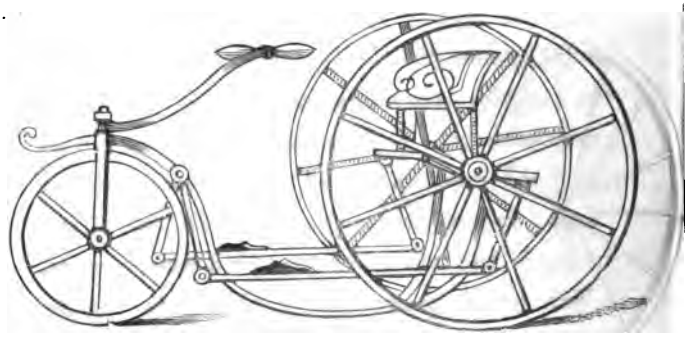


Fig. 15.—LISLE'S LADIES' ENGLISH VELOCIPEDE.

levers, acting on cranks in the axle of the rear wheels. The seat is a cushion chair of horsehair and wicker-work, fixed between the hind wheels, and supported by the reach and bearings on the axles. Mr. Lisle's "Ladies'

English Velocipede" (Fig. 15) furnishes a good pattern of this elegant vehicle.

The downward curve of the reach in this pattern does away with the objection to the

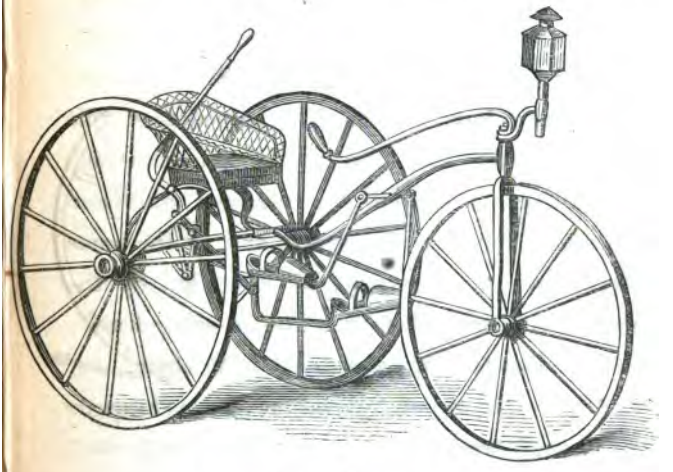


Fig. 16.—LADIES' PARISIAN TRICYCLE.

Parisian tricycle (Fig. 16), in which the reach is either straight and suggestive of an ungraceful attitude, or curved sideways, which is emblematic of weakness. The pedals are fur-

nished with slipper-shaped rests for the feet, and are so formed as to enable the rider to disengage her foot instantly. The motive power is similar to that of weaving, and is analogous to walking. There is no pressure of the foot, and the leg is fully extended without any cramping effort. Some of the larger and more powerful velocipedes of this principle (see Fig. 16) are fitted with side levers, which act on the cranked axle and materially increase the speed, and at the same time serve, if necessary, as a brake, by the rider pressing against it. The steering handle is fixed like that of an ordinary Bath chair.

Since the recent revival of the velocipede movement there have been many suggestive improvements; but there are none which increase the power. A favourite notion is the use of direct foot motion on the cranked knee or toggle joint; and the other the use of a fixed straight lever acting in the same manner by the weight of the body. I have seen three-

wheeled velocipedes with the two driving-wheels in front, attached to a triangular frame, but neither the rider nor the lookers-on pronounced it a success. There was some difficulty in steering it, and it had an inherent disposition to travel backwards. Except for ladies, the treadle machines offer no advantages. They afford healthful exercise to the fair sex, and, on comparatively level ground, they would doubtless be found an agreeable adjunct to a country life.

In many fashionable spas, Bath chairs, furnished with a handle and multiplying-wheels, are frequently seen, in which invalids can move themselves about. They are an admirable contrivance for exercise, but their speed is that of the tortoise, not of the hare.

The "Rantoone" velocipede of Messrs. Ransome is a modification of a tricycle, with levers and treadles.

"FOUR-WHEELERS."

No description of velocipedes would be perfect without some allusion to the favourite "four-wheeler" of the past generation of mechanics. The idea of the four-wheeler is perfect security, space for a companion, and an imposing appearance. The drawbacks are want of control, steering-brakes, loss of power, and expense. There are numberless varieties and patterns of these machines, all of which have their admirers. Amongst the best, if not the very best, is one manufactured by Mr. Andrews, of Dublin, the construction of which will be best understood by reference to Figs. 17 and 18.

The frame of this velocipede is made of the best inch-square iron, seven feet long between perpendiculars. The treadles are made of the best ash, 1½ inch by 1¼ inch, 6 feet 6 inches long. The wheels should be made as the best

velocipede wheels are made, of elm stocks, 4 inches by 5 inches; hickory spokes, which should not exceed $\frac{7}{8}$ inch by $\frac{3}{4}$ inch, tapering to $\frac{3}{4}$ inch to $\frac{1}{2}$ inch. The felloes are made of best ash, bent in one piece, so that they only require one joining; light steel tires. Mr. Andrews makes his wheels 3 feet 4 inches high; but if similar wheels are made for a bicycle they should not exceed 32 or 34 inches high. The fore wheels move freely on an axle, which is fixed by a pivot, to the reach or frame, and a steering-handle is likewise attached to the axle by a lever-brace. The reach is curved upwards, to support a cross-bar on which the treadles are suspended: it is forked under the seat, and lies over the cranked axle on brass bearings. The seat should be made as light as possible, of some wicker or cane work, and may be stuffed with hair.

This form of velocipede admits of hand-levers being fitted, as shown by the dotted lines, Fig. 17. The other dotted lines show the

positions for a valise, box, or portmanteau at the back of the seat or above the front axle.

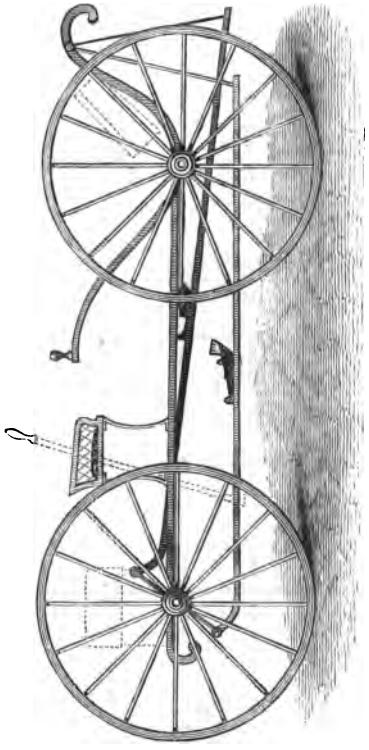


Fig. 17.—THE DUBLIN VELOCIPEDE.

Mr. Sawyer, of Dover, is another well-known maker of four-wheelers.

One of the most recent suggestions for the improvement of this class of velocipedes is to

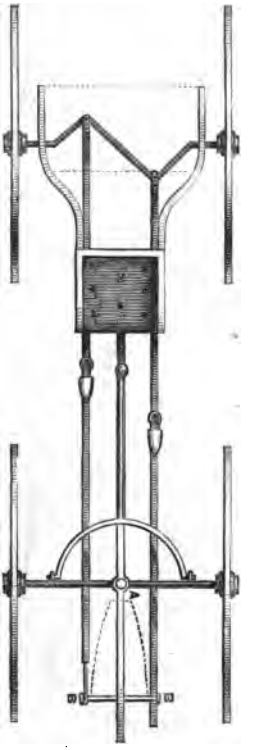


Fig. 18.—THE DUBLIN FOUR-WHEELER.

gain additional power by dispensing with the treadles, and permit the feet to work directly

on knee-joints in the axle of the front wheels. This plan does not overcome the objections that have been raised to the four-wheelers in general.

ART OF VELOCIPEDE MANAGEMENT.

THE ART OF VELOCIPEDE MANAGEMENT.

As in most other accomplishments, practice alone can make a skilful rider of velocipedes. The tyro can, however, profit by the experience of others, and I give a few rules for his guidance as well as directions for his practice. The first point is to gain confidence in, and familiarity with, his wheel horse. If he has had one made according to the directions in this manual, he will know its parts and proportions intimately. If he has but recently purchased one, he should walk by its side, guiding it by the handle until he knows its movements thoroughly. He will see that it obeys, almost like a "thing of life,"

the slightest movement of the handle, and follows the driving-wheel in all its tortuous movements.

The second step of progress is to gain and keep the balance when astride on the saddle. This is apparently a very difficult feat to accomplish, but really it is not so. After sitting for a few minutes in the velocipede, with the toes touching the ground, the vehicle may be placed on a slight incline, so that it may run down of its own accord. The handle must be gripped firmly and steadily, and the feet just lifted from the ground. If there is a disposition to swerve either to the right or left, in consequence of the inclination of the body disturbing the equilibrium, a slight alteration of the pressure on the handle will restore the lost balance.

In the riding-schools it is usual for the assistant to steady the velocipede in the earlier lessons; but, like learning to swim on corks, it is far better to dispense with this extraneous aid, so that the rider may study the action of the

machine himself. He will find the sensation peculiar at first, but a slight practice will habituate him to it. At first he will wish the handles were firmer, for each nervous twist that he gives it as the machine moves is calculated either to upset his balance or to turn the vehicle out of a straight line.

A few runs down an incline will pave the way for the first real lesson on self-propulsion. At first, it will be better to lift each leg alternately, so that they may follow the movement of the pedal without exerting any force. This will habituate the knees and feet to the movement. It is during this practice that the arm of a friend or the ready hand of a skilled assistant is valuable, as there is always a disposition to press too hardly on the pedal. It does not require the strength of an elephant to turn the driving-wheel, even on the roughest road; and in these preliminary trials it is quite unnecessary.

The engraving (Fig. 19) "The Mount,"

shows the position of starting. Observe the position of the pedal, on which the left leg is

Fig. 19.—THE MOUNT.

resting. It is placed in such a position that the mere weight of the rider will cause the

machine to move. Ere he has brought the foot down, his right leg will find a resting-

Fig. 20.—THE START. JUST OFF.

place on the corresponding pedal, and by the exercise of a *little* downward pressure alter-

nately as each pedal turns, progress will be made, as shown in Fig. 20 and Fig. 21.

It is very important that the pedals should be placed at the angle indicated, as it gives the necessary impetus to the start. Should there be any danger of falling, take the foot off the pedals on the side and rest it on the ground, and commence afresh. It is by no means uncommon for the learner to be able to run a distance of fifty or sixty yards after a few hours' practice. To alight it is only necessary to apply the brake by turning the handle. To slacken the speed, release the feet from the pedals and place them simultaneously on the ground.

In all the earlier essays choose some unfrequented road for practice, and avoid as far possible a crowded thoroughfare.

Practise at first down hill; the use of the brake will at all times prevent excessive speed.

Beware of advancing vehicles and abrupt crossing of roads. Do not ride on the foot-paths!

When practice has given a tolerable com-

mand over the vehicle (and a young, active man will acquire that command in a fortnight's

Fig. 21.—PREPARING TO GO DOWN HILL.

practice of a couple of hours a day), the legs may be elevated to the rest when the velocipede

descends a hill, so that it may run free. The preliminary position of doing this is shown in Fig. 21.

The right leg is raised on to the cross rest beneath the angle, whilst the hands firmly grasp the handle. A slight effort will raise the left leg to the other side of the rest (Fig. 22). The velocipede will run now down hill by its own gravitation, whilst the rider controls its movements by the aid of the brake. It requires but little practice to perform this feat adroitly. In fact, the greater the speed the more perfect the balance.

In all early efforts the ascent of a hill should be avoided. It is very discouraging to the learner, and causes him to lose confidence in himself and his vehicle. When perfect command is obtained over the velocipede, comparatively steep hills may be ascended without much difficulty. Old velocipedists all affirm that it is better and wiser on long journeys to walk up the hills, for there is a much less

expenditure of power in walking up the hills and leading the bicycle, or even pushing a four-

Fig. 22.—Off Down Hill.

wheeler, than in attempting to force it along by means of the treadles.

With respect to the command over the velocipede, I have seen comparative beginners, in the course of a month's practice, describe a series of circles or a figure of eight with ease. It is by no means impossible to turn a circle at full speed a little more in diameter than the length of the machine itself.

One of the objections made to the use of the bicycle is that a slight impediment would cause it to overturn; but practically this is not the case. A recent velocipede steeplechase at the gymnasium at Liverpool showed that the bicycle could perform wonders, going easily over large thick mats and planks spread about without upsetting the riders; as many as three mats were cleared at one time in excellent style. During this race Mr. Shepherd, one of the velocipedists, mounted on to the narrow seat, and balanced himself on one foot whilst the bicycle was going at a rapid rate. The vehicles used were the strong iron ones manufactured by Mr. Brown, of Liverpool.

HOW TO CONSTRUCT A BICYCLE.

HOW TO CONSTRUCT A BICYCLE.

HOWEVER popular and however common velocipedes may become, there will always remain a large section of the people to whom they will be and must be inaccessible, in consequence of their price. At first sight there seems no reason why so large a sum should be charged for them. The lowest price quoted, as far as I have seen, was 35*s.* for a tricycle adapted for rural postmen by Mr. Lisle, of Wolverhampton. For a well-built bicycle, the lowest price yet quoted is £7. 7*s.*, though the advertised prices range from £10 to £20.

Bicycles have been sold in America as high as 200 dollars, with ivory handles and ornamental platings of silver. In Paris they are sold at all prices, from two hundred to four hundred francs. Vélocipèdes de luxe, such as that presented to the Prince Imperial, mount up to any sum, according to the amount of rose-wood, carving, and aluminium bronze used.

Then there are numerous etceteras sold. Valise, lantern, oil-bottle, or grease-box, spanner in case of the machine getting out of order, or india-rubber cushions for the iron cross-bar in front of the bicycle, on which the feet rest when going down hill. A cover too is wanted for the vehicle, to preserve it from dust, and some add an indicator to mark the distance travelled.

This sum is larger in consequence of the liability of the bicycle to rough usage and accidents. The best material must be used in their construction, or the result will be failure. Every piece must be made by hand of wrought

iron, steel, or brass. Cast iron has been used and failed. It was dangerous to the rider, and pecuniarily fatal to the manufacturer. In large manufactories a variety of artisans are employed. One of the great American manufactories "employs draughtsmen to design improvements, pattern-makers to prepare models for the foundry, blacksmiths to do the forging, wheelwrights for the wheels, machinists and fitters to turn and fit the various parts, foundrymen to cast the pedals and traces, boltmakers to make the rivets and bolts, saddlers to prepare the seats, and painters and varnishers to finish the machines for the ware-room." Still it is possible for any ingenious mechanic to make one for himself, if he attends to the dimensions and directions herewith given.

THE WHEELS

Are of course the principal portion of the vehicle. They have been advertised at 30*s.* the pair when made of iron. Good hickory wheels with steel tires cost more than that sum. The iron ones would probably prove as lasting.

The driving-wheel should never exceed 36 inches in diameter. An ordinary-sized man would find 30 inches high enough, for the pedals may be graduated on a slide to suit the length of leg and stride required. The height of the saddle should always admit of the feet being placed on the ground. This enables the rider to rest when tired in an easy position, and gives him power to preserve himself from many an ugly tumble in the beginning of his career.

The dimensions of a full-sized French velocipede are various. If the driving-wheel is 36 inches in diameter, the rear wheel should

not exceed 32 inches, and it is better to have two of 30 inches, so that it may be converted into a tricycle. The length between the centres should not exceed 44 inches. The rear wheels should run free on a fixed axle. The axle of the driving-wheel is either a part of the iron wheel, or keyed on to it, fitted with either square nuts or ornamental caps to keep the pedal-stays firmly in their places.

An exceedingly useful size, perhaps the most useful, is to have the driving-wheel 30 inches in diameter, and the rear wheel 27 inches. The length between the centres would then be 30 inches.

In the description of the "Dublin Four-wheeler" (*ante*, p. 73) the dimension of hickory wheels is given. Some additional strength is secured by placing the spokes on the nave-stock alternately on one side and the other of the centre, as shown in Fig. 23. By far the cheapest plan is to buy a pair of tubular iron wheels.

If, however, it is more handy to procure wooden wheels,

THE AXLE

will have to be considered. It should be made of bar steel, one inch square, and keyed into the wooden nave with flat keys, or what is better, a flat plate may be screwed on either side of the nave, with a square hole to fit the axle. The first inch of the axle outside the nave must be rounded to receive the fork. The next inch should be left square to receive the crank (Fig. 25), which may either be secured by an ordinary linch-pin as at A, Fig. 23, or by a screw and nut as at B. Another plan may be

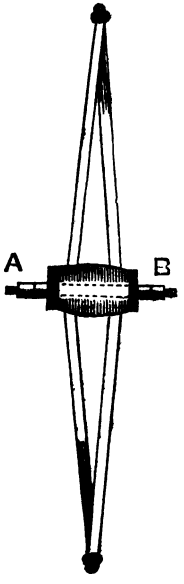


Fig. 23.

followed which has many advantages. The wheel may be left free on the axle as in an ordinary carriage, and on the outside of the nave a strong iron plate, Fig. 24, may be

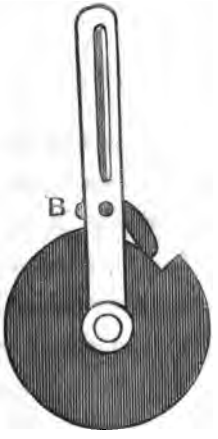


Fig. 24.

Fig. 25.

screwed, working with a ratchet-catch, B. The crank arm will then run free when descending an incline. This modification is far better adapted for a treadle bicycle

than for a bicycle, and can only be recommended when the nave of the wheel needs strengthening. As the rear wheel runs free on the axle, it may be secured by a simple nut and screw on each side of the reach-fork, or by a linch-pin.

THE CRANK-SHAFT

is shown at Fig. 25. The groove or slot enables the crank-pin bearing the pedal to be adjusted to any length required. It may be made of $\frac{3}{8}$-inch iron. The groove or slot should be $\frac{3}{8}$ inch wide, and the width of the crank should be $1\frac{1}{2}$ inch, as the strain is very great.

THE PEDALS

or stirrup are made of various shapes; those in the form of a slipper are now almost universally discarded in favour of the two varieties shown in Fig. 26. The first (A) is a three-

sided wooden pedal with a circular brass flange turning freely on the crank-pin. The pressure of the foot will always bring one of the sides into proper position. They are so shaped as to allow of the use of the fore-part of the foot, bringing the ankle-joint in play,

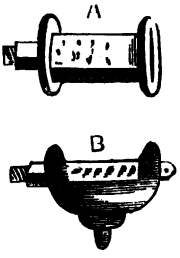


Fig. 26.

relieving the knee, and rendering propulsion much easier than when the shank of the foot is alone used, as in the slippers. The pattern B, which is weighted so as always to present the same surface to the foot, has many admirers. They are adjusted on the crank by means of a nut and screw. A plain crank-iron without a reel may be used,

THE GUIDE-FORK, OR BRACE.

is variously formed. The fork itself is half the diameter of the wheel, with sufficient play to let the latter run free. The bearing should be bushed with brass or composition metal. Thus, if the wheel is 30 inches high, the fork would have to be 16 inches, and the shaft 9 inches, It should be filed square at the top to secure the fork of the steering-handle, and the upper part tapped to receive a nut.

Fig. 27.

THE STEERING-HANDLE

may be made of any fancy curve, a variety of which are shown in the engravings of the

bicycles. A plain fork (Fig. 28) will answer every purpose of use and ornament. The shaft of the handles should have a hole drilled to receive the brake-cord, if one is used, or

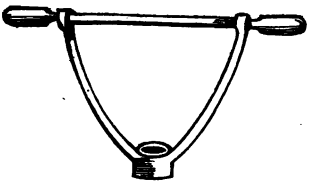


Fig. 28.

an eyelet-hole may be welded on. The handles should be of wood.

THE REACH, OR BEARING-SHAFT,

is the most important portion of the whole, for unless it is of good material and well made, no possible satisfaction can be given. The simplest made and the cheapest is that shown in Fig. 7, but a handy smith would

have but little difficulty in forming one similar to the Hanlon Velocipede (Fig. 11). A good stout ash bar is within the reach of every country, and the majority of town lads; a cooper, joiner, or wheelwright, if the lad has no tools, would shape it into a form similar to Fig. 29. It should be some 4 feet long,

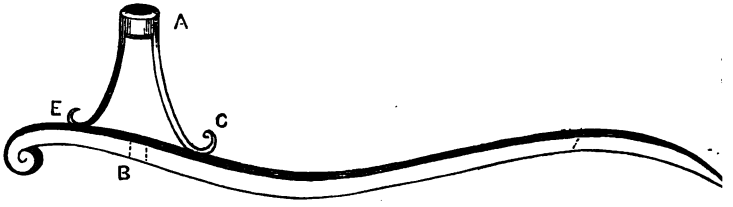


Fig. 29.

and 3 inches by 2 inches scantling. The bow carrying a collar, A, should be made of iron, and screwed to the bearing-shaft, to receive the guide-fork, and a brass collar should be let into the shaft immediately beneath for the same purpose, as shown by dotted lines at B. The two supports to the hind wheel,

one on each side, should be of a V shape, as in Fig. 30, so that they may be tightly screwed to the shaft. The arm might be lengthened

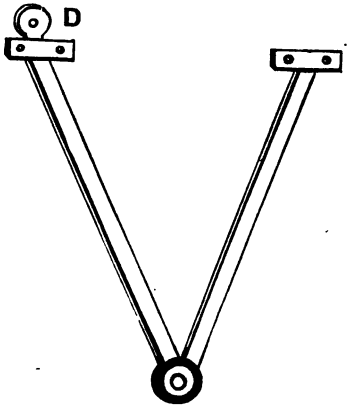


Fig. 30.

at D on both sides, so that a pin or bolt could be inserted to support a steel spring for a saddle, the other end of which may be secured at C, Fig. 29. Or,

THE SADDLE

may be supported on two spiral springs, or

by eighteen inches of steel spring bolted through on the right side of the shaft at C, in the shape of Fig. 31. The saddle itself may be

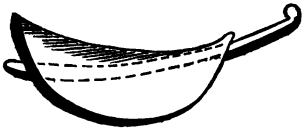


Fig. 31.

of wood, or stuffed with wool, and covered with leather or American cloth.

THE FITTING

must next be considered. The brace-fork must be fitted on the driving-wheel by screwing the caps to the flange and oiling it well. The crank-shafts must follow at right angles to each other, and the nuts screwed tightly home. The bearing-shaft or reach should now be placed on the fork. Ere this is done, a collar of india-rubber

or a coil or two of spiral spring should be placed over the outside of the fork, between it and the shaft, to act as a buffer. If neither india-rubber nor spring be handy, a few pieces of leather and cloth will be useful to prevent the jarring of the machine. The steering-handle may be fitted on and screwed down. It may require a few iron washers or rings to come firmly down to the collar; but this must not be screwed too tight. The V supports may now be secured in their places by bolts being run through the screw-holes and secured on the other side with nuts, so that the work will be exactly parallel. This is better than the plan shown in Fig. 7 of making the supports into forks and bolting them through the wood. The first plan strengthens, and the latter weakens, the shaft. The rear wheel may now be placed. A strong but simple steel bolt, with a linch-pin or nut, will answer for an axle. Fit on the saddle, and your velocipede is complete, with the exception of the brake, which is

hardly necessary; but, if desired, it can be screwed beneath the shaft, so as to act on the hind wheel, as shown in Fig. 7. A piece of catgut, or even sash-cord if knotted to the steering-handle and passed through a gimlet-hole in the shaft and attached to the

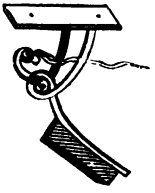


Fig. 32.

end of the brake, will furnish sufficient power on the steering-handle being turned round. Fig. 32 shows the ordinary construction of a brake. It is made of iron, but the shaded part is wood, which will require renewing occasionally. Now you have a bicycle; ride, practise, and prosper.

VELOCIPEDUM VARIORUM.

VELOCIPEDUM VARIORUM.

If one half of the suggestions which have been made for the use and improvement of velocipedes were turned to practical account, we should have air, earth, fire, and water vehicles in multifarious variety. Whether that famous six or seven-wheeler, which is to carry a family party by a treadle movement, will ever become a reality it is difficult to say. The performance, to say the least of it, would be of a very cranky order. Wind velocipedes are nearly as old as the hills. They have been tried with flat and revolving sails, combining in the latter instance a land boat and a windmill, all of which are duly described in

the "Sailing-boat," by Mr. H. C. Folkard, and the results chronicled even to the frightening of a farmer's wife and upsetting her in a ditch.

The marine velocipede, the podoscaphe, or *vélocipède marin*, which is the last new Parisian notion, has been tried for years with some success. Those on the lake of the Bois de Boulogne are "formed of a couple of canoes covered with canvas and joined together by two iron bars, between which is a paddle-wheel, put in motion by means of two pedals placed at the extremity of the arc." There was a talk that some enterprising gentleman would cross the Channel on one of these machines, but he has not yet done so. Some of the marine velocipedes suggested are manumotive machines, the movement of which is analogous to turning a mangle. Machines of this kind have been used for years without any great results being achieved.

Several suggestions have been made with

respect to the application of steam to velocipedes. It might, and perhaps will be done; but then they will cease to be velocipedes. Read some of the latest ideas on the subject. The vehicle is to be constructed to carry two.

"The means for working consists of a pair of oscillating cylinders, situated behind the carriage, driving a small cranked stage, having upon it the two driving-wheels. Steam is supplied from a small boiler, located in the front, and carried through the steam-pipe into the trunnion-box between the cylinders, and after performing its work, finds its passage into the exhaust-pipe in the usual manner. The exhaust-pipe is in connection with the funnel of the boiler, the latter being located underneath the carriage, so that no inconvenience may arise from smoke in front. The heat, too, from the boiler may all be avoided by placing around it some non-conducting material. A handle whereby the brake may be applied is in a convenient position, and may be used to

one or both wheels, and the guide-wheel, worked by gearing, is so placed that it may easily be handled by a passenger, who has the opportunity of transforming himself (for the time

Fig. 33.

being) into an amateur engine-driver and stoker. Coals are carried in a bunker, situate in front of the boiler."

The proposers and inventors may console themselves by knowing that in Mr. Stewart's pleasant "Anecdotes of the Steam-Engine,"

published forty years ago, there is a little vignette, a similar contrivance, of which Fig. 33 is a *fac-simile*. The design seems

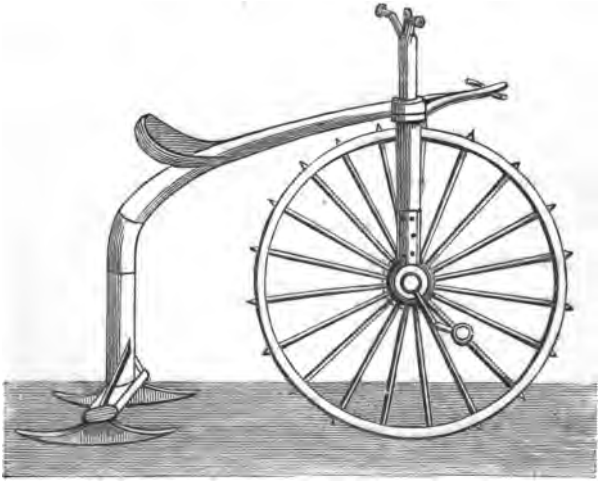


Fig. 34.—AMERICAN ICE VELOCIPEDE.

to ridicule Messrs. Baynes, Brunton, Dumbell Tindal, and Co. A reference to the "Aids to Locomotion," issued by the Patent Office, will show that the idea dates at least from 1813.

The American ice velocipede (Fig. 34) is a much more sensible contrivance. It is literally skating by means of machinery. The design originally appeared in *Harper's Weekly*, and the machine is intended to be used on ice or frozen snow. The driving-wheel is armed with sharp points to prevent the possibility of slipping, which proved so fatal to M. Dreuze's machine. The hind wheel is replaced by a pair of gigantic skates or runners, similar to those used in sleighs or ice-boats. It is hardly likely to have a fair trial in England.

This vehicle, with its one wheel, seems to have tickled the fancy of a Mr. John St. Leger Partridge, who has, or is going to bring out the "Victorine," or one-wheeled velocipede. *Bell's Life* informs the public, however, that this gentleman's labours in this direction have occupied the better portion of the last fourteen years. It is his intention, we are told, "to test publicly the merits of his machine by an open trial. To this end he issues a

challenge to all comers to a race of velocipedes, of any model, to some town not more than a hundred or less than fifty miles from London. He further offers to give one mile start for every twenty in the course decided on, the road selected to be a fair average one as to ascents and descents. This "sensation" match will doubtless be watched with much curiosity, as the Americans have attempted progression *en vélocipède* with positively one wheel." This Mr. John St. Leger Partridge must have taken a lesson out of Mr. Dumbell's idea, which is a spherical ball, with compartments; or he must have adopted a squirrel-cage, or the clown's idea of riding on a barrel. The American idea is a combination of the two.

Far more useful and interesting are the various forms of a child's velocipede. The Prince Imperial, on the occasion of the Fête de Pâques, presented ten miniature velocipedes in aluminium bronze to his friends. The majority of the juvenile velocipedes are merely small varieties

of those used by the seniors. There is, however, an adaptation of the "cantering propeller" affixed to a tricycle, which combines the pleasure of a rocking-horse with actual progression. Such are a few of the many forms which velocipedes have assumed during the past fifteen months.

PROGRESS OF THE VELOCIPEDE.

PROGRESS OF THE VELOCIPEDE.

La Belle France was the cradle of the velocipede. All that we know of its history points to France as its birth-place, and we are convinced now that its resuscitation is due to the *petits crevés* and *cocottes* of Paris.

What a change from the cumbersome machine of M. Blanchard to the light and airy bicycle of the modern Parisian; but the change in popular opinion is even greater. It is true that caricaturists still make them the butt of their wit-pointed pencils; prince and peasant, noble and bourgeois, — all vie with each other in their admiration of the new vehicle. A vivid account of the scene

presented by the riders appears in the *London Society* for November. We are told that 123 miles have been accomplished within the twenty-four hours, and that fifty miles in five hours have been repeatedly accomplished. Those who witnessed the feats of the French velocipedists at the Crystal Palace at Easter will believe all the stories of the dashing rides along parapets, and the marvellous races that have taken place. The riders frequently wear jockey caps and coloured jackets to distinguish them. One of the most frequent trials of skill is who shall go slowest, and who can ride best without any steering apparatus. At these races the prize is often a silver cup or a sum of money. The average length of the course is 1,800 mètres, which is nearly equivalent to a mile and a furlong. This distance has been done in four minutes and twenty-five seconds, although a portion of it was over a stone-paved road, by a bicycle. A tricycle took two minutes longer to perform

the same distance. A racing speed of a mile in five minutes for a distance of two or three miles is very excellent riding.

A variety of suggestions have been thrown out with respect to their use. The *Salut de Lyon* states that rural postmen are mounted on them. Telegraph messengers are recommended to use them. Even country doctors and parsons are recommended to try the new iron horse which requires no corn. Artists, electors, and sportsmen are reported as using them. No wonder, then, that when the velocipede was introduced into America, the Yankees exclaimed that "walking was on its last legs." They seized with avidity the new idea, though, until the fall of 1868, they do not appear to have excited much popular attention. The *Scientific American* notices their existence in the records of new patents earlier in the year, but gives no description of the new vehicle until later. The other American journals just notice the novelty,

and then exclaim that pedestrianism has had its day and must bow before the conquering run of the newer light. Its motion was described as graceful. It was a thing of life, moving with a smooth grace, alike exhilarating and beautiful to behold. They were introduced into the theatres, as in Paris, and the designer, in *Harper's Weekly*, represented the new year 1869 as coming into the world seated on one of the new contrivances. The American public were treated to anecdotes of races between velocipedes and the street cars, in which the former were victorious, unless they met with a "foul," as in the famous race on Indiana Avenue, at Chicago. Races took place in Cincinnati, where the prize was a silver cup, worth 100 dollars, for the fastest, and another, of equal value, to the slowest rider. Mr. Dana of the *New York Sun*, himself an experienced velocipedist, even advocated a project to build an elevated railway from Harlem to the Battery —from one end of New York to the other—for

the use of riders of velocipedes only. By this means it was estimated that it would be possible to go from one end of Manhattan Island to the other, barring stoppages and accidents, in an hour. The proposed roadway was to be thirty feet wide, on an iron framework, and the flooring of hard pine. This idea seems to have infected an English inventor, if we may judge from a recent application for a patent.

On the 28th of November, 1868, a public race took place in New York, when the tall French pattern was very generally condemned, and the pattern now known as the American (Fig. 9) preferred. It was at first known as the Pickering velocipede, and the driving-wheel never exceeded three feet in diameter. The most popular pattern was one with the driving-wheel 33 inches high. The frame was made of hydraulic iron tubing, as more simple, lighter, stronger, and cheaper than any other material. They were made by gauge, so that if any portion met with an accident or wore out, it could be

instantly replaced. Of the other three patterns, the Monod, which was the French pattern (Fig. 8), received a large share of support; and those made by the Brothers Hanlon (Fig. 11) and Messrs. Wood were looked upon with favour. At the beginning of the year the demand was so great that there was the greatest difficulty in procuring velocipedes of any pattern. The manufacturers were overwhelmed with orders. The riding-schools, and the rooms opened by the manufacturers, were found too limited for the accommodation of those anxious to learn the new mode of locomotion. Art galleries were converted into velocipede training-institutions; and it was no wonder that the supply fell a month into arrear of the demand.

At the beginning of January it was estimated that there were in New York and its immediate vicinity alone no less than 5,000 persons who either knew how to ride the velocipede or were learning, and it was estimated that at least half

that number would be mounted during the summer. The side streets were thronged with them; but the city authorities forbade the use of the parks to the "carriage of the people." The great difficulty, present and to come, is to find places to ride in.

It was not to be expected that the American carriage manufacturers would permit so profitable a branch of manufacture to slip through their fingers, and it was not surprising that they soon began to devote a large portion of their establishments to the manufacture of the popular vehicle. It was understood that any manufacturer was at liberty to make the two-wheeled velocipede in any way he deemed most profitable, no one being aware of the fact that the machine had been duly patented and the exclusive right secured by a little Yankee foresight and ingenuity.

As far back as 1866, the *Scientific American* recorded a patent for the two-wheel velocipede with treadles and guiding-arms, known as

Lallement's patent, but no one appeared to take notice of the fact, for bicycles were then a thing of the future—a French toy, which no one thought of. When, however, it was obvious that a "big thing" was to be done in velocipedes, Mr. Calvin Witty, of No. 638, Broadway, New York, went quietly to ascertain how the manufacture could be controlled, and he speedily found out the holders of the patent, which covered the principle of the bicycle, and bought the exclusive right of manufacturing and using treadles and guiding-arms in America. The surprise and indignation of the various manufacturers can be easily judged, when they received a polite intimation from Mr. Witty, that they were infringing his patent, and requesting a settlement for the past infringements. They pooh-poohed the claims, laughed at the notices, held meetings, but they found that the law was on Mr. Witty's side, and they had to purchase from him a license to manufacture. That gentleman has doubtless hit

upon a mine of wealth to reward his shrewdness in forestalling the coming time, unless the opposing claim of Stephen W. Smith, also of New York, is substantiated, for he claims the invention altogether. He states that he invented and perfected the bicycle in New York, and afterwards introduced it into France himself by patent. This claim is again disputed by Mr. P. W. Mackenzie, whose "Cantering Propeller" was patented in 1862, and whose specification embraces all the principles of Lallement's patent (Fig. 6, p. 47). In the mean time the demand for velocipedes goes on, and is yet unsatisfied.

In England we are supposed to be a sensible people, neither affecting the excitement of the French or the sensationalism of the Americans, yet in the matter of velocipedes we have indulged in some strange vagaries. We at least have proposed velocipede railways. We have the "one-wheeler;" and we, too, have had races. On Wednesday, the 14th of April, 1869,

Mr. C. A. Booth, the champion of skating, performed the journey from London to Brighton on a bicycle, 52 miles in 7½ hours. Previously this had only been done in 9½ hours. In Liverpool the gymnasiums are crowded nightly by expectant riders. Manchester has caught the fever. Birmingham has the symptoms. London is talking over the new excitement. The watering-places are thankful for the new sensation, and embryo riders exclaim—

> I shall have no horse to feed,
> Though I ride on a velocipede.

Ere I say farewell, let me caution velocipedists, past, present, and prospective, against expecting too much from any description of velocipede. They do not give power, they only utilize. There must be an expenditure of power to produce speed. One is inclined to agree with the temperate remarks of Mr. Lander, C.E., of Liverpool, rather than with the extravagant enthusiasm of American or

French riders. As a means of healthful exercise it is worthy of attention. Certainly not more than forty miles in a day of eight hours can be done with ease. Mr. Lander thinks only thirty. If this is correct, it does not beat walking, though velocipedists affirm that double the distance can be done with ease. Much will and must depend on the skill of the rider, the state of the roads, and the country to be travelled.

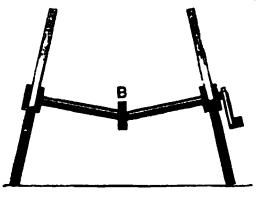


Fig. 35.

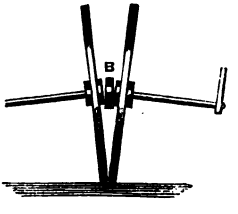


Fig. 36.

THE ELYRIA VELOCIPEDE.

WYMAN AND SONS, PRINTERS, GREAT QUEEN STREET, LONDON, W.C.

AUG 21 1919

APPROVED EDUCATIONAL WORKS.

HISTORIES.

A History of England, from the Earliest Times to the year 1858. By the Rev. JAMES WHITE, M.A. With a copious Historical Index. In post 8vo, cloth, *7s. 6d.*

The Fall of Rome and the Rise of New Nationalities. A Series of Lectures on the Connection between Ancient and Modern History. By JOHN J. SHEPPARD, D.C.L., Head Master of Kidderminster School. In post 8vo, cloth, price *7s. 6d.*

Motley's Rise and Fall of the Dutch Republic. With an Illustration. In post 8vo, cloth, gilt edges, *6s.*

The Victoria History of England to 1863. By ARTHUR BAILEY THOMPSON. Printed on toned paper, with 400 Illustrations by Dalziel Brothers. In crown 8vo, cloth (*750* pages), price *6s.*

"This is, on the whole, the best History of England for young people which we have yet met with. The plan of the volume is excellent, and the chronological index, tables, and maps of the appendix, will make a useful handy book even for older readers."—*Daily News.*

A Picture History of England for the Young. By Dr. DULCKEN. With 80 large Illustrations, engraved by the Brothers Dalziel. In 4to, cloth gilt, price *5s.*

The History of France, from the Invasion of the Franks under Clovis, to the Accession of Louis Philippe. By EMILE DE BONNECHOSE. A New Edition, translated from the latest Paris Edition. In 12mo, cloth, price *5s.*

The History of British India, from the Earliest English Intercourse. By CHARLES MACFARLANE. With 8 Illustrations and a Map. In fcap. 8vo, cloth, price *5s.*

D'Aubigné's History of the Reformation of the Sixteenth Century. Abridged and Translated by the Rev. J. GILL. In post 8vo, cloth, price *5s.*

"Mr. Gill's careful and judicious abridgment of D'Aubigné's History of the Reformation cannot fail to be acceptable to the numerous class of readers who lack either time or opportunity to study the original work."—*Spectator.*

Goldsmith's History of England. In fcap. 8vo, cloth, *2s.*

Watts's Scripture History, with a Map. In fcap. 8vo, cloth (300 pages), price 2s. A cheaper Edition of this Work is also kept, 32mo, cloth (370 pages), price 1s.

White's Landmarks of the History of England. In fcap. 8vo, cloth, 1s. 8d.

White's Landmarks of the History of Greece. In fcap. 8vo, cloth, 1s. 8d.

LONDON: GEORGE ROUTLEDGE AND SONS.